

# Sensory Substitution and Virtual Spaces: Exploring the Potential of the Tongue as a Powerful Sensory Gateway

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In our increasingly interconnected and technologically advanced world, the fields of sensory substitution and virtual spaces have gained significant attention. Currently, virtual space technologies only refer to the most reliable and relatively objective senses of the human however the implementation of the other ones is just to come. In this paper, I will delve into the concept of sensory substitution by investigating the role of the tongue and taste buds and its possible relevance to the creation of unique physical sensory experiences in virtual environments. I will first examine the concept of sensory substitution and its place within the emerging physical sensory experiences then move on to the connection to the tongue which has the potential of acting as a gateway to those experiences by investigating the current undertakings in the real world. Finally, I will introduce a series of micro-stories revolving around the concept of utilizing the tongue for different experiences and explore the unorthodox relationship between the virtual worlds and the human body.

Sensory substitution refers to the process of using one sensory modality to convey information that is typically received through another. It involves translating sensory input from one sense into a format that can be perceived and interpreted by another sense,

allowing individuals to gain information about the environment or their own body through alternative channels. There are many implementations of sensory substitution as a method of enhancing engagement with the environment. As all of the senses can be translated into each other with different techniques, one example of the visual-to-auditory substitution is the vOICe system which uses a camera to capture visual images and translates them into a soundscape. Different pitches, tones, and rhythms represent different visual features such as brightness, location, and movement. Another example is a visual-to-tactile substitution which utilizes tactile feedback in return for visual input. Brainport devices use this procedure to visualize the environment for the user. The device has a camera that captures visual information, which is then transformed into electrical stimulation patterns on the tongue, allowing visually impaired individuals to see the world as patterns of tingling sensations on their tongue(Layton, n.d). Moreover, Bach-y-Rita, who passed away in 2006 and is recognized as the pioneer of sensory substitution, often emphasized that systems like Braille and white canes can also be regarded as sensory-substitution methods. These systems replace visual information, such as text on a page or distant objects, with tactile sensations. Bach-y-Rita even suggested that writing should be seen as the initial form of sensory substitution since it

allowed the auditory experience of spoken words to be presented visually (Lepore, 2017).

The tongue possesses sensory capabilities and can serve as an interface for translating non-tactile or non-visual information into tactile or visual sensations. The surface of the tongue is covered with numerous small bumps called papillae, which contain taste buds responsible for detecting different tastes. Additionally, the tongue is also rich in tactile receptors known as mechanoreceptors, which are sensitive to touch and pressure. These mechanoreceptors provide the tongue with the ability to perceive tactile sensations and play an essential role in our sense of touch and texture perception.(reference)

Furthermore, synesthesia, a unique condition where the stimulation of one sensory or cognitive pathway triggers involuntary experiences in another sensory or cognitive pathway, provides a captivating insight into the intricate workings of our brain's sensory processing. It is a captivating phenomenon that illuminates the intricate crossroads of our sensory perceptions. It beckons us to delve into the fascinating interplay between what we see and what we hear, often resulting in a confluence of sensations that seem inexplicably intertwined. It is proposed that connections between visual shapes and auditory perceptions find their roots in an extensive body of work that reveals the profound nature of the phenomena. Several pioneering studies, such as those conducted by Kohler (1929), Lindauer (1990), Marks (1996), and Ramachandran & Hubbard (2001), have shed light on this sensory phenomenon, offering valuable insights into the synesthetic

experiences that grace our perceptual world. (Mauer and Specter, 2009) In the case of synesthesia involving taste and touch, individuals can encounter tactile sensations on their tongues even without any physical contact with an object. The mere exposure to specific visual or auditory stimuli can evoke the perception of distinct textures on their tongue. This extraordinary cross-sensory experience is attributed to the presence of atypical neural connections in the brain, enabling different sensory pathways to intertwine and merge. Although synesthesia remains rare and its mechanisms not entirely understood, it serves as a testament to the remarkable complexity of our brain's ability to process and integrate sensory information, exceeding the conventional boundaries of individual senses.

#### **TALES FROM THE BUDS - MICRO STORIES**

Exploring the concepts of sensory substitution and the anatomy of the tongue, I have created five micro-stories which are taking place in the same fictional universe and around the same time. Stories highlight the relation between feeling with the tongue and the probable translations of what the tongue feels to another sensation. These stories investigate speculatively what possible effects this kind of advancement would have daily. All of the stories involve an edible matter, by which the human body goes into a synesthetic and subconscious state and the characters experience a different state in their minds and bodies. The experiences can vary from one to another however the method is always the same: licking a candy with their tongue.

## Trap

A mysterious candy appeared seemingly out of thin air on every street corner. As people cautiously licked it in the beginning, their tongues tingled with an astonishing array of sensations. Each candy held a hidden message, revealing secrets encoded in the texture. A hacker community emerged, cracking the texture patterns like tactile detectives. But they soon realized the candies were a lure—every lick bound them deeper in a virtual labyrinth, their minds forever lost in the realm of textured illusions.

## Reminiscence

A single hard candy floating on the table was inviting her with its surprising texture. As her tongue grazed its surface, her memories from almost 200 years ago were released, projecting vivid scenes from her past. Before it starts to fully affect her perception, she started to read its impacts on the wrapping. She was having a challenging time seeing it, but it expanded her urge to read the riddle of the candy that lies in its ability to unlock latent neural connections, resurrecting forgotten experiences. But as she indulged in nostalgia, she grew disconnected from reality, becoming trapped in her personal histories, forever reliving fragments of the past.

## Annihilation

They were visiting the marketplace with a massive enthusiasm. When they see its crystalline surface shimmered with shifting colors, promising to evoke specific feelings, they were enchanted. It was the same moment that they paid to the over-friendly traveler, and the magical candy was on their tongue. They eagerly licked it, surrendering control to the candy's emotive power. But hidden within its sugary core was a subtle twist—the candy amplified emotions to extreme levels, tumbling them into a turbulent state of uncontrollable despair. They suddenly felt broken by not

comprehending if this is their own emotions or just a dream. They slowly molten into the pot of somber emotions which will be their final stop to the edge of emotional annihilation.

## **Truth**

As he was found guilty by the majority of the population and left for the removal process, he slowly placed a cryptic candy wrapped in a blank paper in Detective Harper's pocket. Harper's curiosity sparked but she tried not to seem so excited. Just after leaving the agora, she let it dissolve on her tongue, savoring its enigmatic textures. The taste transported her into a world where mysteries were woven into the fabric of sensations. With each second that she spend with the candy in her mouth, Harper navigated the intricate web of his case. The candy became her silent partner, revealing the truth hidden in the depths of the tactile realm. Though she had so little time to save him from the removal.

## **Echoes**

in the depths of Zone 5, whispers of forbidden knowledge spread. A stranger offered him a tiny, shimmering orb expecting him to eat it. Curiosity approached, and he popped it into his mouth. The world melts away as the orb dissolved, smudging his tongue. His mind is flooded with visions of forgotten civilizations. The taste of ancient ruins lingers, and he now understands the weight of history on his tongue. It was thrilling but also terrifying at the same time that he ultimately reached the juncture to know all the prohibited secrets. There stood the guardians, who were waiting for their assignment of exterminating the one who discovered everything.

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